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- (71) Applicants  
BBC Brown Boveri &  
Company Limited,  
CH-5401 Baden,  
Switzerland.
- (72) Inventors  
Edwin Beck  
Arthur Stocker
- (74) Agents  
A.A. Thornton & Co.

(54) Device supporting the windings of an electrical machine having salient poles

(57) A device supporting the field windings of an electrical generator rotor with salient poles 2 comprises a pair of members, such as angle members 5, 6, bearing against the two free surfaces of the coils 3 of adjacent poles and gripped in relation to one another, for example by a bolt and pressing

members 8, 9. Reliable support is achieved without weakening the rotor body or impairing the flow of cooling air. In other embodiments different constructions using angle members are disclosed (Figures 2, 3 and 4, not shown). Also disclosed is a construction where the angle members are formed as a single member (Figure 5, not shown), and constructions using two cross members (Figures 6 and 7 not shown).

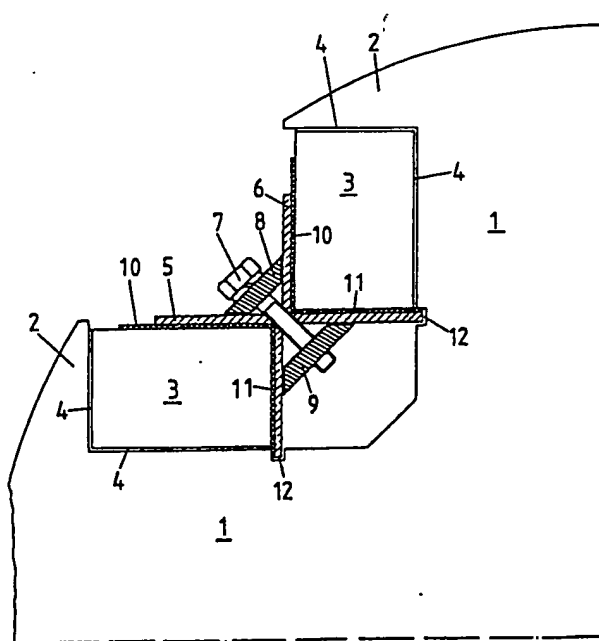


FIG.1

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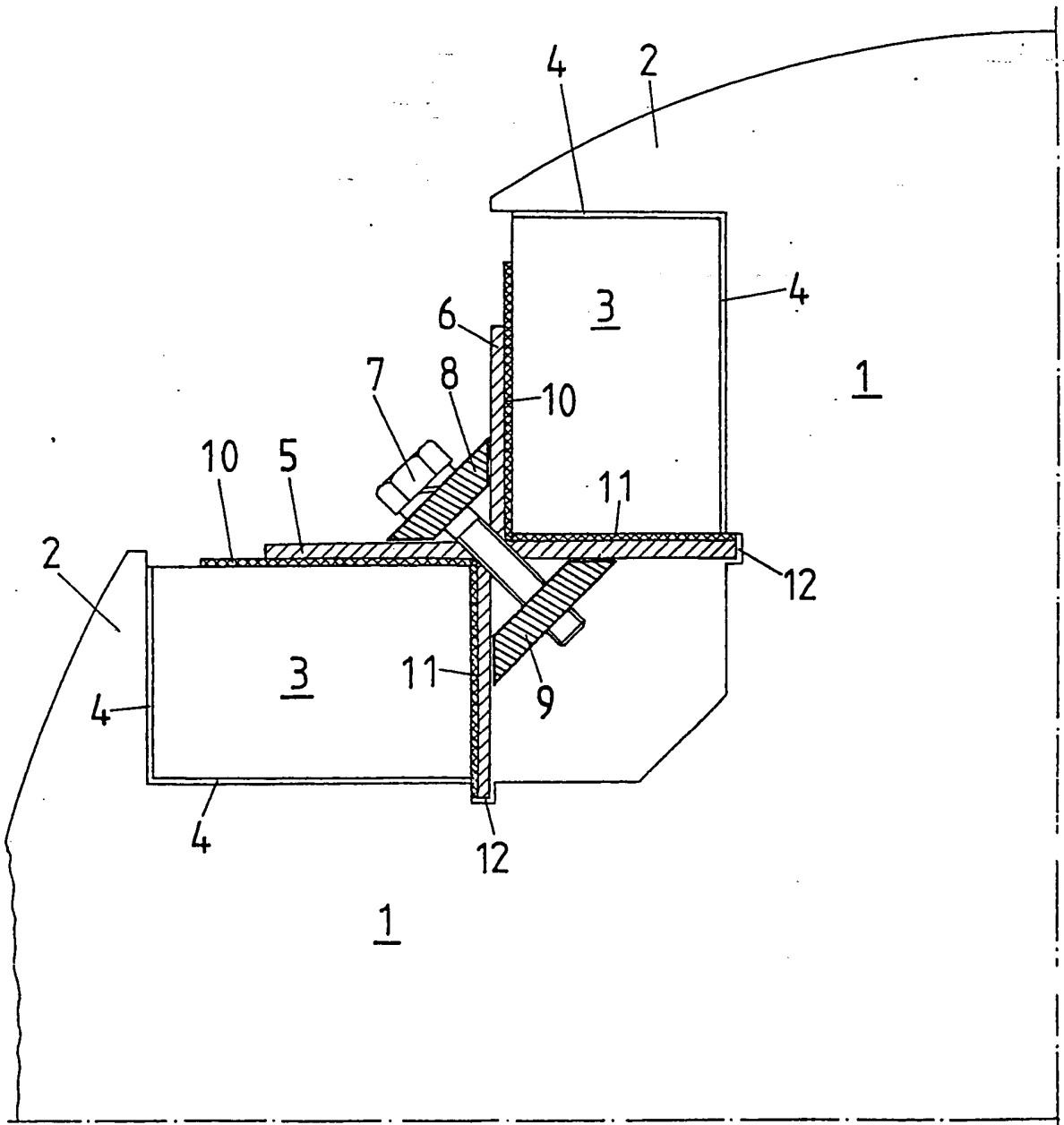


FIG.1

FIG. 2

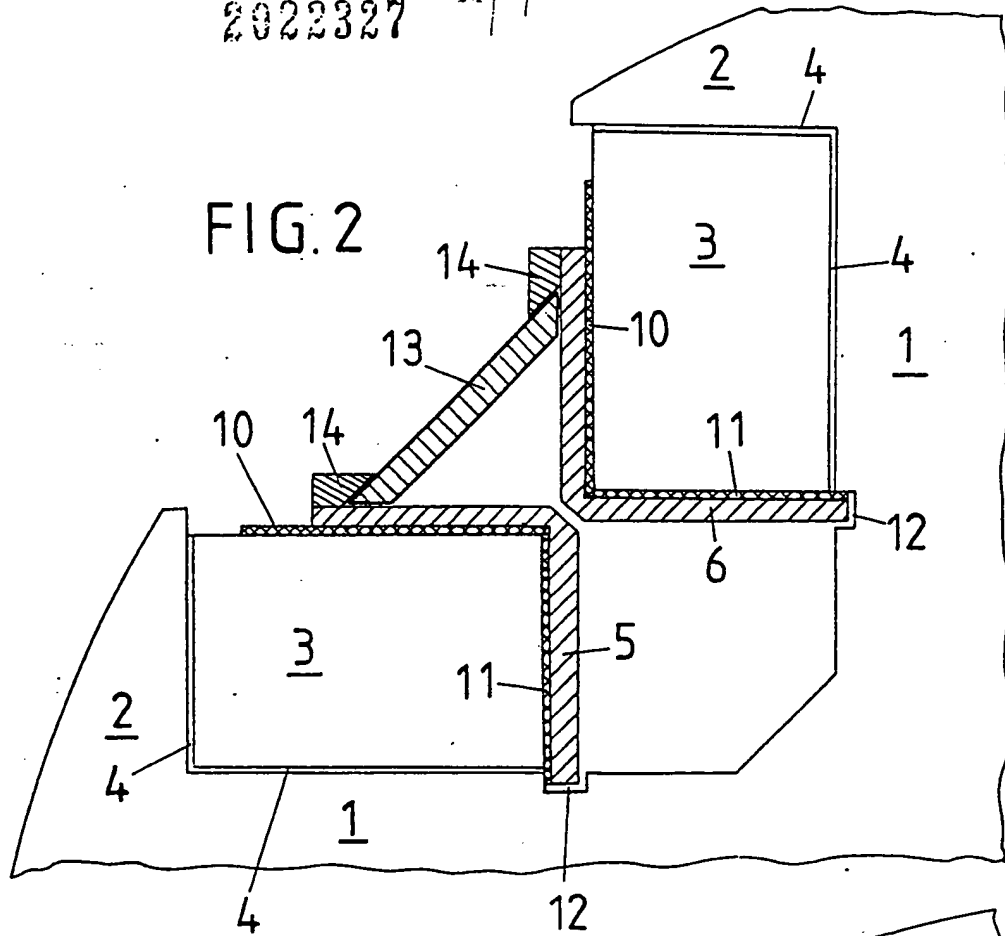


FIG. 3

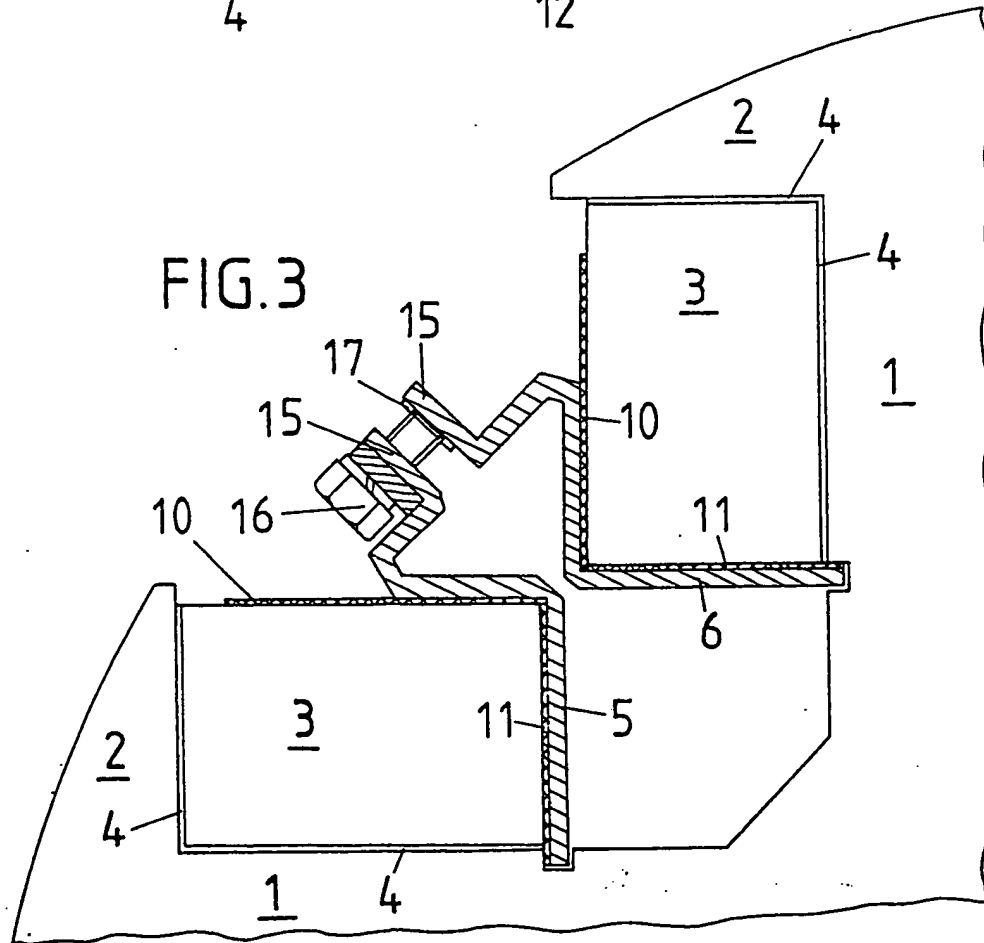


FIG. 4

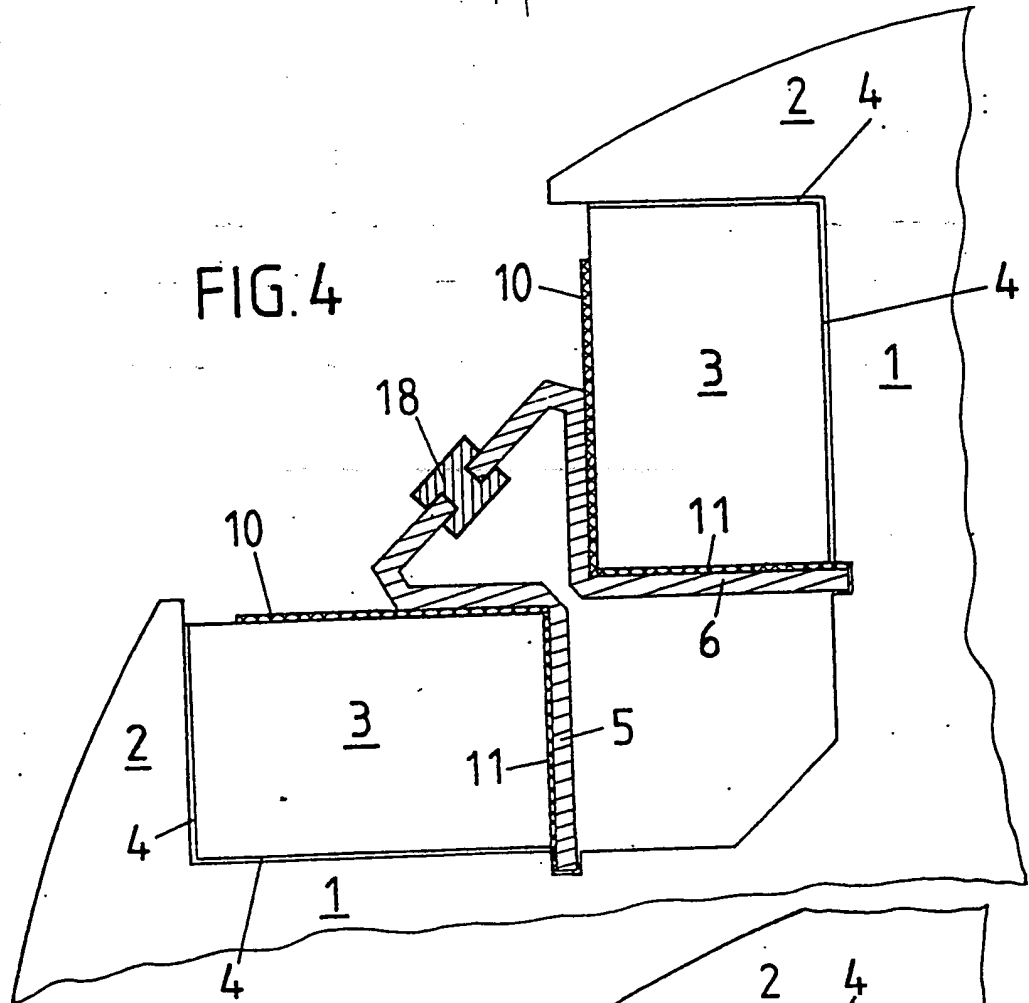
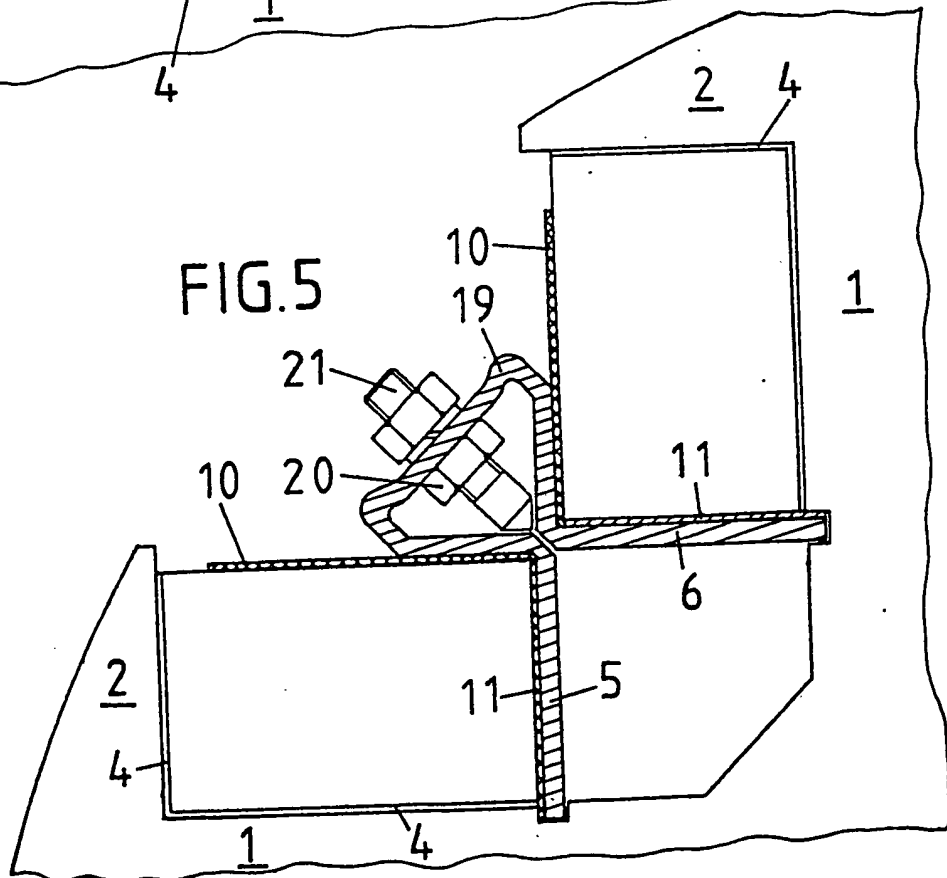


FIG. 5



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FIG.7

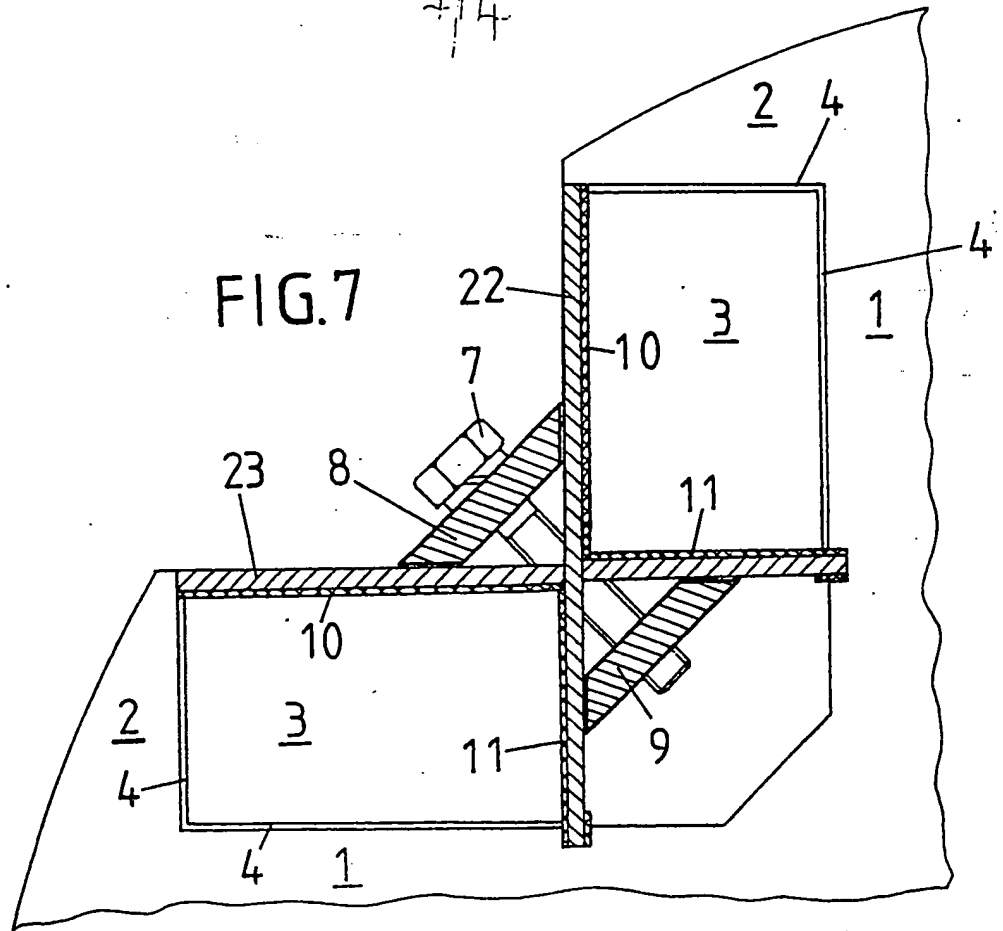
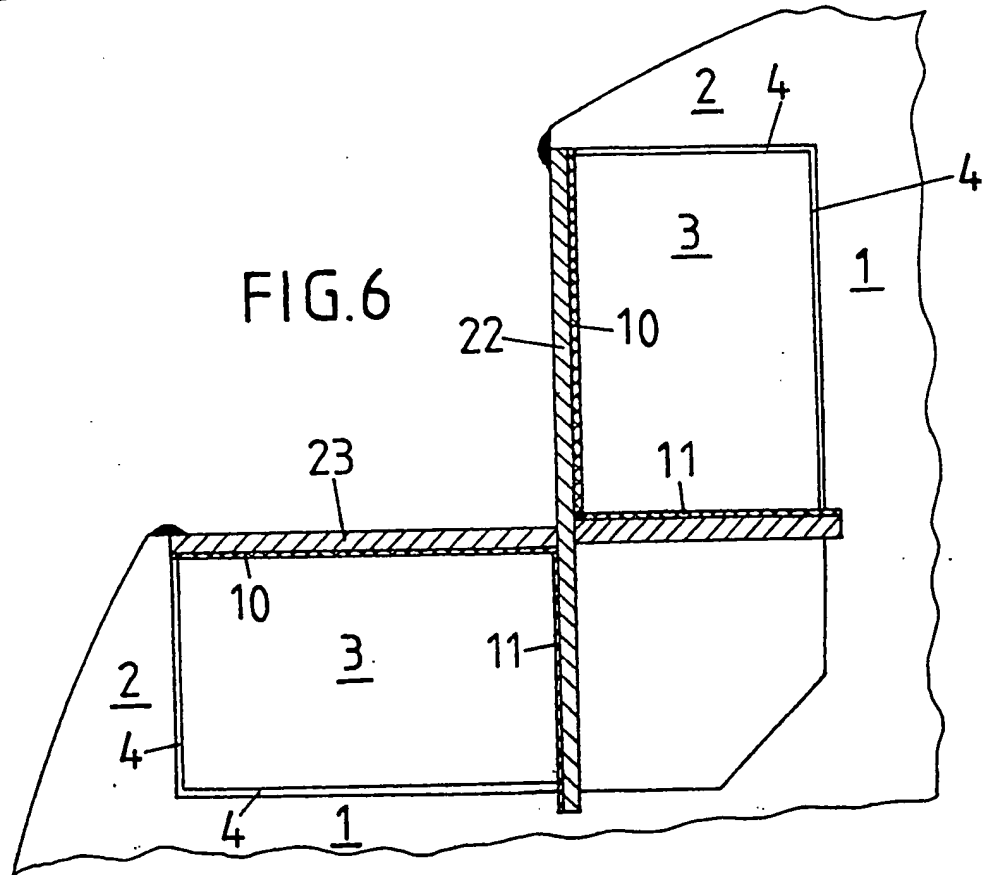


FIG.6



## SPECIFICATION

**Device supporting the windings of an electrical machine rotor with salient poles**

- 5 The invention relates to a device for supporting the windings of an electrical machine rotor or spider with salient poles by means of a supporting means inserted between the coils of two adjacent poles.
- Supporting devices for the field windings of field spiders or rotors with salient poles must essentially satisfy three conditions:
- a) reliable support in relation to the forces acting in operation;
  - b) the rotor body should not be weakened, if possible, by grooves or bores in which the supporting devices are anchored; and
  - c) the supporting devices should oppose as little resistance as possible to the passage of the cooling air.
- 20 In a supporting device known from West German patent specification 1 199 871, which is provided for high-speed low-power current generators, the supporting member is made V-shaped and comprises two resilient arms with which it is pressed in
- 25 between the field coils under initial tension and with the free ends of which it is supported, so as to be self-holding, in relation to the pole shoes projecting beyond the field coils, without any further securing. It is less suitable, however, for larger machines,
- 30 particularly for 4-pole machines, because there the supporting members, which are now right-angled, can no longer fulfil the supporting function by spring force alone. Additional holding devices, for example support of the radially inner portion of the supporting member on the rotor body, hamper the (axial) passage of cooling air.
- As seen from one aspect, the invention provides a device supporting the windings of an electrical machine spider or rotor with salient poles, comprising a supporting means inserted between the coils of two adjacent poles, the supporting means comprising a pair of angle members bearing at least partially against the two free surfaces of each of the respective coils and supporting each other mutually.
- 45 As seen from a second aspect, the invention provides a device supporting the windings of an electrical machine spider or rotor with salient poles, comprising a supporting means inserted between the coils of two adjacent poles, the supporting means comprising two crossed flat members which bear at least partially against the two free surfaces of each of the respective coils, which flat members are gripped in relation to one another or are connected to the pole shoes and/or to the pole cores.
- 55 Embodiments to be described herein are distinguished by simple and economic construction and ensure a reliable support of the field coils in relation to the centrifugal forces occurring in operation, without the passage of cooling air being adversely affected to an appreciable extent.
- 60 In one embodiment, the angle members are gripped in relation to one another by means of a pressing device consisting of a screw bolt and pressing members. The pressing members are

one another. This embodiment has the advantage, in particular, that practically inevitable manufacturing tolerances of the field coils can be taken into consideration without adapting the supporting member. In addition, tightening of the supporting device is possible at any time.

- 70 In a second embodiment, the radially outer ends of the angle members are connected by a strut. The strut may be welded in or be held by appropriately shaped guide rails placed on the outer faces of the angle members. In both cases, the geometry of the arrangement is such that the outer arms of the angle members are urged apart by the strut.

In other embodiments, the ends of the angle members are bent towards one another and gripped in relation to one another either by a connecting piece with an H-section or by a screw bolt, and in the first case the mutually supporting surfaces of the angle members and/or of the connecting piece are chamfered in wedge-shape. Both alternatives render possible the subsequent tightening of the supporting device.

In another embodiment, the radially outer ends of the angle members are connected to one another by means of a web. The angle members are gripped in relation to one another by means of a threaded bolt which is supported on the web and on the arms of the angle members.

The form of the invention using crossed flat members renders possible two different variants of the mutual supporting of the flat members, either by a pressing device or by welding or other connection to the pole shoes and/or the pole core.

Embodiments of the invention will now be described, by way of examples only, with reference to the accompanying drawings, in which:

*Figure 1* is a partial section through a first embodiment of a supporting device, wherein the field coils are supported in relation to one another by angle members and a pressing device consisting of screw bolts and pressing members;

*Figure 2* is a similar section through a modification of the embodiment of *Figure 1*, wherein the field coils are supported in relation to one another by means of angle members and a strut connecting them;

*Figure 3* is a similar section through an embodiment with the ends of the angle members bent towards one another, wherein said ends are gripped in relation to one another by means of a screw bolt;

*Figure 4* is a similar section through a modification of the embodiment of *Figure 3*, wherein the ends of the angle members end in a connecting piece with an H-section;

*Figure 5* is a similar section through a further embodiment with angle members connected by means of a web;

*Figure 6* is a similar section through an embodiment with two crossed flat members which are gripped in relation to one another by means of a pressing device; and

*Figure 7* is a similar section through an embodiment with crossed flat members which are connected to the pole shoe.

field spider or rotor of an electrical machine with salient poles is illustrated diagrammatically. The poles consisting of pole core 1 and pole shoe 2 comprise field coils 3 of flat conductors, profile wire or round wire. More details of the construction of the field coils are described, for example in the book "Konstruktion elektrischer Maschinen" by Wiedemann/Kellenberger, Springer Verlag 1967, pages 320 et seq. The field coils 3 are electrically insulated from the poles by means of intermediate insulating layers 4 of glass fabric or the like.

In Figure 1, resting on the free faces of the field coils 3 are angle members 5, 6 which are gripped in relation to one another by means of a pressing device formed from a screw bolt 7 with two like pressing members 8, 9 with wedge-shaped chamfers. Insulating elements 10, 11 are inserted between the arms of the angle members 5, 6 and the field coils. The inner ends of the arms of the angle members are extended beyond the field coils and end in flat grooves 12 in the pole cores 1. The width of the groove is made larger than the thickness of the arm, so as to compensate, if necessary, for manufacturing tolerances in the coils or to make allowance for the setting of the field coils after spinning or in operation during the tightening.

It is expressly pointed out that the provision of the grooves 12 and the extension of the ends of the arms of the angle members 5, 6 represent measures only to be adopted if necessary.

In the arrangement illustrated in Figure 2, the mutual supporting of the field coils is effected by a strut 13 which is inserted between the outer arms of the angle members 5, 6 and which extends substantially at the angle of 45° to the arms. The strut 13 is chamfered in wedge-shape and is held by guide rails 14 as indicated in the Figure. The strut may also be welded to the angle members 5, 6 (not illustrated). In addition, it may be advisable to spot-weld the strut 13 to the guide rails 14 or to connect them rigidly to one another by other means.

In the embodiment shown in Figure 3, the radially outer ends of the angle members 5, 6 are bent towards one another at an angle of about 135° and are provided with strap-like extensions 15. One of the straps is provided with a thread in which a screw bolt 16 is screwed. The end of the screw bolt is guided in a recess in the other strap or a superimposed ring 17. By tightening the screw bolt 16, the radially outer arms of the angle members 5, 6 are urged apart and support the field coils 3 in relation to one another. Here, too, as in Figure 2, it may be advisable, if necessary, to allow the inner arms of the angles to end in grooves 12 in the pole core 1.

In the embodiment of Figure 4, which should be regarded as a modification of that of Figure 3, the ends of the arms of the angle members 5, 6 bent towards one another end in a connecting piece 18 with an H-shaped cross section. The end faces of the ends of the angle members and possibly the central portion of the connecting piece are chamfered in wedge-shape (seen in the direction of the machine axis), which facilitates the tightening of the angle members and their subsequent tightening.

In the device of Figure 5, the two angle members 5,

6 are connected to one another by an inwardly arched web 19 which extends substantially parallel to the angle bisector of the arms. A threaded nut 20 is fitted to the inside of the web. The angle members 5, 6 can be parted by means of a threaded bolt 21 with a conical end and so press the field coils against the poles.

In the devices shown in Figures 6 and 7, the field coils 3 are mutually supported by means of cross flat members 22, 23. The radially outer ends of the flat members are welded to the pole shoes in the arrangement shown in Figure 6, while in the embodiment according to Figure 7 a pressing device 7, 8, 9 as described in connection with Figure 1, serves for the mutual gripping of the flat members.

## CLAIMS

1. A device supporting the windings of an electrical machine spider or rotor with salient poles, comprising a supporting means inserted between the coils of two adjacent poles, the supporting means comprising a pair of angle members bearing at least partially against the two free surfaces of each of the respective coils and supporting each other mutually.

2. A device supporting the windings of an electrical machine spider or rotor with salient poles, comprising a supporting means inserted between the coils of two adjacent poles, the supporting means comprising two crossed flat members which bear at least partially against the two free surfaces of each of the respective coils, which flat members are gripped in relation to one another or are connected to the pole shoes and/or to the pole cores.

3. A device as claimed in claim 1, in which the angle members are gripped in relation to one another by means of a pressing device consisting of a screw bolt and pressing members.

4. A device as claimed in claim 1, in which the radially outer ends of the angle members are gripped in relation to one another by a strut or struts which extend substantially parallel to the angle bisectors of the two angle members and connected to the angle members.

5. A device as claimed in claim 1, in which the radially outer ends of the angle members are bent towards one another and are there connected to one another.

6. A device as claimed in claim 5, in which a connecting piece with an H-section is inserted between the ends of the angle members extending towards one another.

7. A device as claimed in claim 5, in which the ends of the angle members extending towards one another are gripped in relation to one another by means of a screw bolt.

8. A device as claimed in claim 1, in which the angle members are connected to one another at their radially outward ends by means of a web and the angle members are mutually supported by means of a threaded bolt supported both in the web and on the radially outward arms of the angle members.

9. A device as claimed in claim 2, in which the

crossing flat members are provided with a recess in the crossing region and are gripped in relation to one another by means of a pressing device consisting of a screw bolt and pressing members.

5 10. A device as claimed in any preceding claim, in which the radially inner ends of the angle members or flat members end in grooves in the pole core and/or pole shoe.

11. A device supporting the windings of an  
10 electrical machine rotor, substantially as herein described with reference to any one of Figures 1-7 of the accompanying drawings.

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